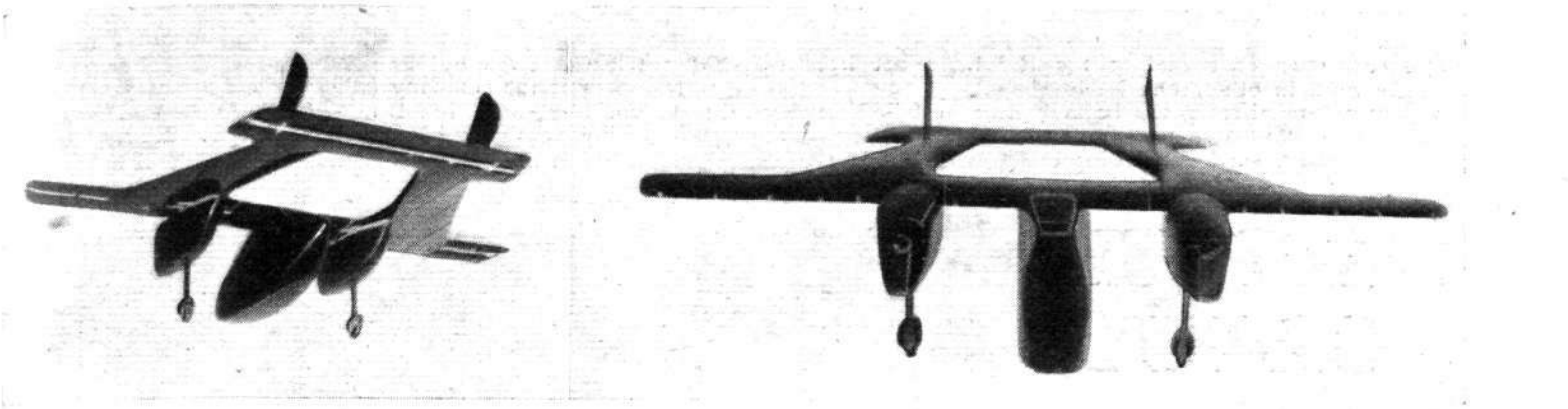


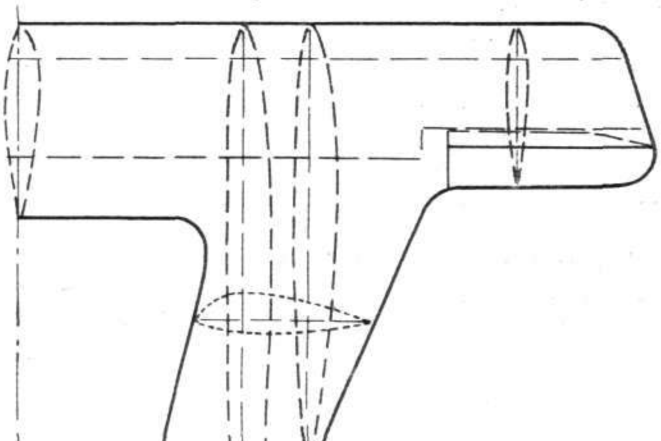
AN AERODYNAMIC NOVELTY

Compound-Aerofoil Machine Under Construction : "Two-way" Camber : High Efficiency Claimed with Low Aspect Ratios

ALTHOUGH the "annular wing" idea is by no means of modern conception, the rectilinear formation as patented by the Willoughby Delta Company, Ltd., promises to meet with greater success than earlier efforts. In any case, after extensive tunnel tests the company is building a small prototype aircraft which should be finished in January.

The company, which was formed in 1931, claims that the unorthodox aerofoil formation which characterises its designs is aerodynamically and structurally ideal for "all-wing" aircraft. Known as the Delta F, the prototype has been planned to test the aerofoil form at as high a speed and with as much spanwise static loading as could economically be demonstrated. The aerofoil is of compound form and is composed of a wing of normal aspect ratio with an outrigged tail unit connected to it by two additional surfaces (termed "side wings") built around the tail booms. The whole unit is cambered into aerofoil sections fore and aft and laterally across the side wings. The formation is known as the Delta aerofoil and is protected by patents in nine countries.

Research has shown that this rectilinear form of annular wing induces a particular form of vortex distribution and vortex control giving high-efficiency characteristics despite the low aspect ratio of the members and that it induces an unorthodox aerodynamic load distribution which permits the fullest advantage to be taken of spanwise static loading, making for a very light structure.

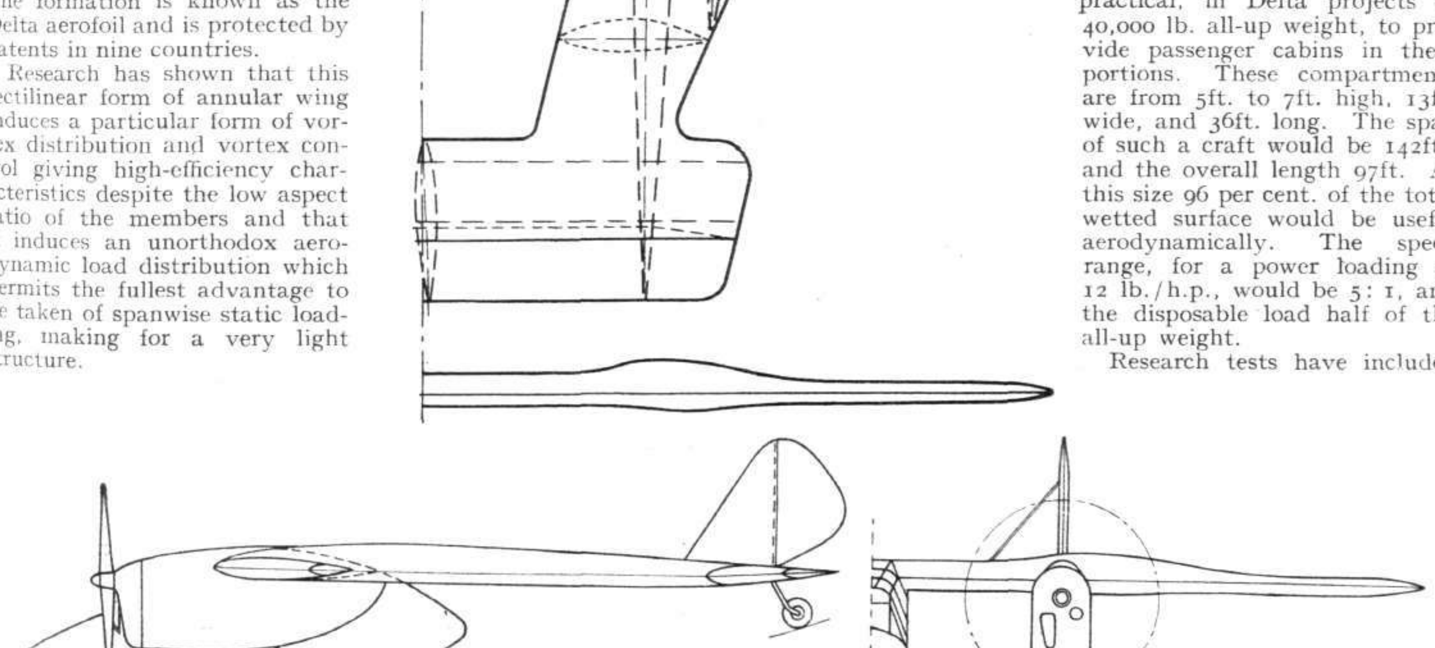


Another peculiarity of the wing form is that its maximum lift is maintained without any effective loss up to angles considerably higher than the designed landing incidence. By adopting a certain curvature over the wing-tip sections it has been possible to obtain a similarly delayed stall over the lateral control surfaces. Owing to the fact that the whole aircraft is practically one aerodynamic unit, the various components of which have effective mutual interactions, the control surfaces become relatively more powerful than might be expected considering their areas.

The low-aspect-ratio side wings perform the unusual function of improving the form drag of the normal wing at high speeds while carrying a low percentage of the total aerodynamic load themselves. At high incidences, it is claimed, they maintain the maximum lift and introduce additional drag. Yet another important function of these side wings is that they reduce considerably the form drag of centrally placed nacelles.

By adopting a thickness ratio of under 12 per cent. for the side wing sections, it has been judged practical, in Delta projects of 40,000 lb. all-up weight, to provide passenger cabins in these portions. These compartments are from 5ft. to 7ft. high, 13ft. wide, and 36ft. long. The span of such a craft would be 142ft., and the overall length 97ft. At this size 96 per cent. of the total wetted surface would be useful aerodynamically. The speed range, for a power loading of 12 lb./h.p., would be 5: 1, and the disposable load half of the all-up weight.

Research tests have included



The peculiar "two-way" camber arrangements are indicated in the upper view, while the side and front elevations bring out other characteristics of the prototype Delta machine.